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MEMORANDUM

To: Paul Peronard
Libby Technical Assistance Unit (TAU)
From: Bill Brattin, Lynn Woodbury
Date: July 2, 2007
Re: Dust Sampling Approach

Per your request, SRC has prepared the following information to facilitate discussions regarding the potential modification of the dust sampling approach for the Libby site.

Table 1 presents summary statistics[1] for dust field samples collected from living spaces and frequently used areas at OU4 properties. This table is stratified by sampling program and the sample type (e.g., horizontal surface or high traffic area).

As seen, the number of samples with detectable levels of Libby amphibole (LA) structures by TEM tends to be low (<10%) for the general investigatory programs (Phase 1/1R, Contaminant Screening Study, Design Phase). The detection frequency is higher for the more focused programs, such as the Phase 2 and SQAPP activity-based sampling (ABS) programs. However, this increase in detection frequency may be due to the lower number of samples collected within these programs and the fact that they utilized a lower target sensitivity. The frequency of dust samples above the clean-up trigger of 5,000 s/cm^2 is less than 2% across all sampling programs. A total of 73 dust samples from 57 properties within OU4 exceed the dust trigger.

Because the detection and exceedance frequencies for dust samples are low, you have asked us to investigate the feasibility of utilizing indicators other than dust sampling to identify properties with elevated dust levels (i.e., > 5000 s/cm^2). The ideal indicator is one that is always present when dust levels exceed 5,000 s/cm^2, and always absent when dust levels are below 5,000 s/cm^2. In other words, to be useful, the indicator must have both a low false positive rate (this occurs when the indicator is present but dust does not exceed 5000 s/cm^2) and a low false negative rate (this occurs when the indicator is absent when the dust level does exceed 5000 s/cm^2). The typical goal would be that the false negative rate is < 5%, and the false positive rate is < 20-30%.

Table 2 presents a summary of the false positive and false negative rates associated with a variety of potential indicators. For the purposes of this effort, the potential

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[1] All data presented in this memo reflect information available in the Libby2DB based on a download performed on June 21, 2007.

indicators evaluated include seven of the triggers assigned as part of the Libby2DB Remediation Status Query and the indoor/outdoor visual status information from the Contaminant Screening Study (CSS) Information Field Forms (IFFs).

Consider the first potential indicator listed in Table 2 – the presence of one or more of the seven remediation triggers listed. For this indicator, 4 of the 57 (7%) properties where dust levels exceeded 5,000 s/cm^2 did not have any other triggers present. This false negative rate is quite close to the goal of 5%. Unfortunately, the false positive rate for this indicator is very high. For the 1,391 properties where dust levels were below 5,000 s/cm^2, one or more triggers were present at 1,330 properties (96%). Therefore, if this indicator were used as a surrogate for dust testing, it would have been incorrectly concluded that dust cleanup was needed at 1,330 properties that were actually below the dust trigger..

As seen in Table 2, while there are several indicators with either a low false negative or a low false positive rate, there are no potential indicators with both a low false negative and false positive rate. This suggests that none of the potential indicators evaluated are a good surrogate for determining the presence/absence of elevated dust levels.

Based on these results, we conclude that there is little alternative for identifying properties with dust levels above 5,000 s/cm^2 except to continue sampling dust at all properties. However, sampling and analysis methods can be modified to reduce field and laboratory costs with little or no impact on data usability. Field sampling protocols for dust could be modified to collect a single 10-point dust composite per property, which is representative of multiple locations and accessibility types, rather than two (or more) 3-point composites. Based on the results to date from the dust pilot study, it seems likely that these 10-point composite samples could also utilize a 30 second sample collection period, rather than the 120 second period currently used.

In addition, analytical requirements for these samples can be modified to specify a target sensitivity of 200 cm^{-2}. This target sensitivity has a very high probability of correctly identifying a sample as being > 5000 s/cm^2 when it really is. Based on the recent changes to the indirect preparation procedures which utilizes a smaller secondary preparation filter (345 mm^2), and given a sample area of 1,000 cm^2 (for a 10-point composite), this target sensitivity will be achieved for most samples after reading only 5 grid openings.

Table 1
Summary Statistics for Dust Field Samples by Sampling Program

Program	Sample Type	# of Samples	# of Detects	Detect. Freq. (%)	# Samples ≥ 5,000 s/cm^2	Exceed. Freq. (%)	Avg LA Dust Loading (s/cm^2)	Max LA Dust Loading (s/cm^2)	Avg Sens. (1/cm^2)
Phase 1/1R	HS	293	25	9%	1	0.3%	256	45,290	1,545
	HS/HT	24	2	8%	0	0%	61	1,327	379
	HT	158	24	15%	4	2.5%	640	56,612	933
	n/s	1,785	260	15%	58	3.2%	705	105,356	1,578
	All	2,260	311	14%	63	2.8%	636	105,356	1,516
Contaminant Screening Study	HS	694	27	4%	0	0%	33	3,985	475
	HS/HT	85	9	11%	0	0%	130	2,898	750
	HT	702	52	7%	4	0.6%	157	17,441	567
	All	1,481	88	6%	4	0.3%	97	17,441	534
Design Phase	HS	894	32	4%	1	0.1%	41	6,605	379
	HS/HT	383	29	8%	2	0.5%	110	7,869	438
	HT	883	41	5%	2	0.2%	50	8,907	373
	All	2,160	102	5%	5	0.2%	57	8,907	387
Clean-up Evaluation	HS/HT	32	0	0%	0	0%	0	0	269
Phase 2 ABS	HS	9	4	44%	0	0%	310	1,350	567
	n/s	29	11	38%	1	3.4%	565	8,492	1,238
	All	38	15	39%	1	2.6%	504	8,492	1,079
SQAPP, Task 2 ABS	HS/HT	16	10	63%	0	0%	74	742	16
SQAPP, Task 6-9	HS/HT	14	4	29%	0	0%	12	71	26
SQAPP, Task 10	HT	12	4	33%	0	0%	196	1,586	195
All Dust Samples		6,013	534	9%	73	1.2%	287	105,356	849

Retricted to microvacuum dust field samples from Libby OU4 collected from living spaces or frequently used areas.
ABS = Activity Based Sampling
HS = horizontal surface
HT = high traffic area
n/s = not specified

73 samples from 57 properties

Table 2

Evaluation of Potential Indicators for Indoor Dust Levels Above 5,000 s/cm^2

Potential Indicator	False Negative		False Positive	
Remediation Status Query				
One or more Triggers	4	7%	1,330	96%
2 - Outdoor Verm In LUA	35	61%	495	36%
3 - Secondary Indication	23	40%	908	65%
4 - Verm In Attic	31	54%	549	39%
6 - Soil ≥ 1%	48	84%	66	5%
7 - Outdoor Verm In EUA	33	58%	723	52%
8 - PLMGrav ≥ 1%	57	100%	6	0%
9 - Soil Detects < 1%	18	32%	593	43%
CSS IFF Survey				
13-Indoor: V+ in Attic	26	55%	480	34%
14-Indoor: V+ in Walls	40	85%	119	8%
15-Indoor: V+ in Crawl Space	46	98%	26	2%
16-Indoor: V-	25	53%	828	58%
17-Indoor: V+ in Basement	45	96%	68	5%
18-Indoor: V+ on Ground Floor	42	89%	54	4%
19-Indoor: V+ on Second Floor	47	100%	7	0%
20-Indoor: V+ in Attached Garage	47	100%	4	0%
21-Indoor: V+ in another location	44	94%	66	5%
22-Outdoor: V+ in Driveway	42	89%	74	5%
23-Outdoor: V+ in Flowerbed	32	68%	492	35%
24-Outdoor: V+ in Garden	36	77%	325	23%
25-Outdoor: V+ in Yard	28	60%	479	34%
26-Outdoor: V+ in Former Flowerbed	46	98%	33	2%
27-Outdoor: V+ in Former Garden	42	89%	130	9%
28-Outdoor: Stockpile present	47	100%	32	2%
29-Outdoor: V-	31	66%	475	33%
30-Outdoor: V+ in another location	45	96%	106	7%

Total N properties in RemedStatus query:

<5,000	1,391
≥5,000	57
	1,448

Total N properties w/IFF:

<5,000	1,423
≥5,000	47
	1,470

Property lists restricted to OU4 with one or more microvacuum dust field samples from living space/frequently used areas.
LUA = large use area
EUA = expected use area

False Negative = (# properties with Dust > 5,000 and Indicator is not present) / (# properties with Dust > 5,000)
Concluding property doesn't require cleanup based on indicator when it would have required cleanup based on dust
Ideal: false negative rate less than 5%

False Positive = (# properties with Dust < 5,000 and Indicator is present) / (# properties with Dust < 5,000)
Concluding property requires cleanup based on indicator when it wouldn't have required cleanup based on dust
Ideal: false positive rate rate less than 20%